A PRECONDITIONER FOR SUBSTRUCTURING BASED ON CONSTRAINED ENERGY MINIMIZATION [1]

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A preconditioner for substructuring based on constrained energy minimization concepts is presented. The preconditioner is applicable to either structured or unstructured meshes and offers a straightforward approach for the iterative solution of second and fourth-order structural mechanics problems. The approach is centered around constraint equations involving displacements of substructure boundaries. These constraints provide the means for preconditioning at both the substructure and global levels.

The method has many similarities with a dual-primal version of FETI called FETI-DP, but there are some important differences. For one, the primary variables for iterative solution are displacements rather than Lagrange multipliers. An important result of using a displacement formulation is that the coarse problem looks much line the original problem. As a result, multilevel extensions for very large problems are straightforward. Such extensions are important when a large coarse problem cannot be solved exactly because of memory or time constraints.

Numerical examples are presented which demonstrate the good performance of the method in terms of iterations and condition numbers. The examples include both scalability studies and analyses of more realistic problems. Theoretical bounds on condition numbers of the preconditioned equations are also presented.

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